

FIRE FIGHTERS GUIDANCE NOTE # 6-34

ISSUE: SOLAR PHOTOVOLTAIC (PV) SYSTEMS

A photovoltaic (PV) installation typically includes:

- Array(s) of solar panels: because a single PV panel can only produce a limited amount of power, a typical PV system installation contains several panels connected together to form an array;
- Inverter(s), which is a power conversion unit that converts direct current (DC) generated by the array to alternating current (AC); and
- interconnecting wiring.

PV systems are used for either on or off grid applications.

In the event of a fire, shutting down the electricity in a building with a PV system is more complicated than in a building without one because the system is energized from two sources (utility and PV system).

The PV system can be isolated from the rest of the building's wiring system by shutting down the "Utility Disconnect" of the PV system in addition to the main electrical switch. These system disconnects are usually located near the meter, main electrical panel, PV system inverter and/or on the rooftop.

The Ontario Electrical Safety Code requires clear marking and labelling of the electrical system equipment indicating the system is fed from more than one source.



EXAMPLE PICTURES PROVIDED BY THE ELECTRICAL SAFETY AUTHORITY**SAFETY CONCERNS:**

- The primary hazard for firefighters dealing with PV installations is electric shock. An array of multiple panels can produce DC current and voltages above 600 volts. This represents a hazard for firefighters if they come in contact with damaged panels or energized exposed wiring during firefighting or ventilation operations.
- The unique characteristics of the DC current generated by a PV system mean that an arcing fault is more intense and sustained than that from AC. In addition, the value of arcing fault current may be too low for the required circuit protective devices to operate. This creates additional fire hazards unique to these systems.
- The solar PV system cannot simply be "switched off". Shutting down the PV's "Utility Disconnect" switch, inverter and the main electrical switch will disconnect the array from the building and/or the grid. However, the PV panels and other apparatus connected from the solar panels to the inverter will always remain energized as long as they are exposed to a source of light. **They should be treated as live electrical equipment.**
- Solar PV systems add additional weight to the roof of a building, which may pose a structural concern. This may require alternative ventilation tactics, particularly where roof joists have been compromised by fire.
- Power cables and PV panels pose trip and slip hazards for roof operations.
- PV panels exposed to fire can produce toxic and carcinogenic combustion products.
- Battery storage areas can generate corrosive/explosive gases when exposed to fire and are another potential source of electric shock.

FIREFIGHTING SAFETY PRECAUTIONS:

When dealing with fires in buildings with solar PV systems, the following should be considered:

- Assume the solar PV array is energized at all times.
- Inform the Incident Commander immediately upon identifying the presence of a solar PV system.
- Remember that securing the main electrical panel, inverter and PV's "Utility Disconnect" switch will not shut down the solar PV system. When exposed to sufficient light, electricity will continue to be generated by the PV system.
- Stay away from the panels and conduit. Do not cut into, remove, or walk on the solar PV system.
- Wear proper PPE including SCBA.
- Contact the local utility provider.
- Fight the fire based on flow, pattern and distances as recommended in the "Electrical Safety Handbook for Emergency Responders – Best Practices for Coping With Electrical Hazards in Rescue and Fire Situations", revised 5th Edition, 2013.

Note: At night, moonlight or apparatus-mounted scene lighting may still produce enough light to generate electricity from the arrays. Lightning strikes can also be bright enough to create an electrical surge in the system.

References:

OHSA Clauses 25(2)(a), (d), and (h)

GN # 6-20 Electrical Hazards in Rescue and Fire Situations

Electrical Safety Handbook for Emergency Responders – Best practices for Coping with Electrical Hazards in Rescue and Fire Situations, [Hydro One Networks Inc., Electrical Safety Authority, Office of the Fire Marshal, and Public Services Health and Safety Association], revised 5th Edition, 2013.

http://www.pshsa.ca/wp-content/uploads/2013/11/EELPWAEN0413-Electrical-Safety-Handbook_20131.pdf

Ontario Fire College Course: Solar Photovoltaic Systems, Wind Turbines and Firefighter Safety

Electrical Safety Authority, *Ontario Electrical Safety Code*, 25th edition, 2012.

This Guidance Note was developed in consultation with the Office of the Fire Marshal and Emergency Management and the Electrical Safety Authority.